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ABSTRACT

In order to ensure that the United States maintains an advanced information infrastructure, the Council on Competitiveness has started a project on the 21st century infrastructure. Participating in this project are the many different parties who are providing and using the infrastructure, including cable companies, regional Bell companies, long distance carriers, cellular firms, computer hardware and software companies, banks, publishers, and universities. Although these groups do not agree on all issues, the Council hopes to develop a consensus to accelerate the deployment of an advanced information infrastructure. This vision statement represents such a consensus. The document begins with an executive summary. The vision statement is then presented. It addresses the need for an advanced information infrastructure and covers the following issues: (1) why the information infrastructure is important; (2) where the United States stands; (3) what the vision is; (4) the roles of the government and the private sector; (5) where to go from here; and (6) what the next steps are in obtaining this goal. (JLB)

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VISION FOR A 21ST CENTURY INFORMATION INFRASTRUCTURE

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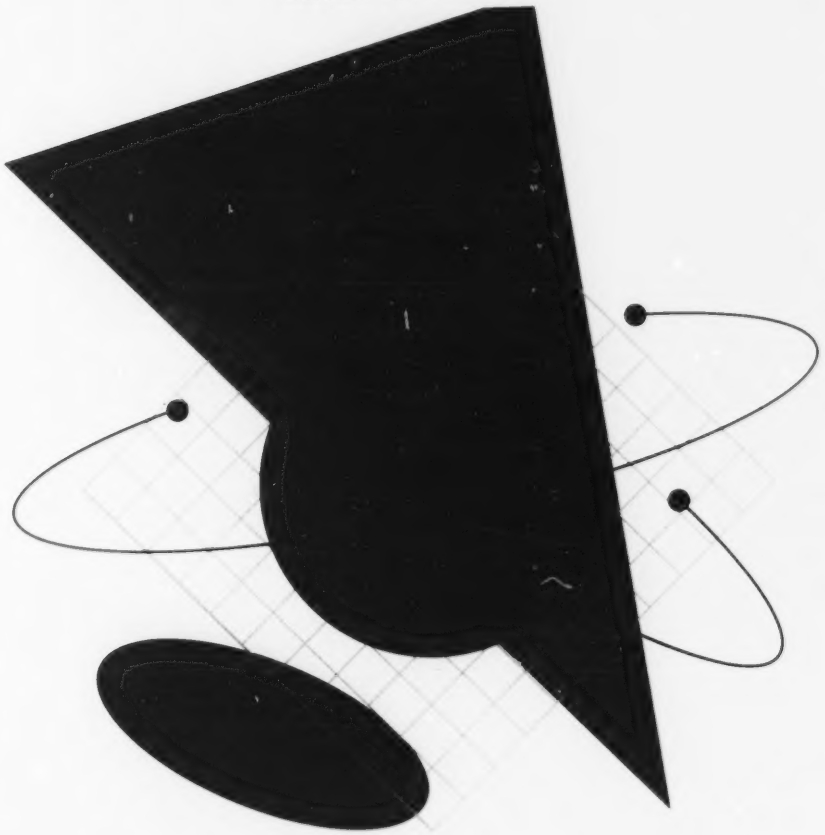

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VISION FOR A 21ST CENTURY INFORMATION INFRASTRUCTURE

MAY 1993

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FOREWORD

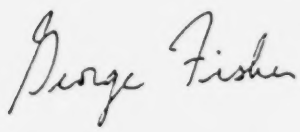
Advances in technology and the rise of international competition have made knowledge the new currency of the global economy. Superior knowledge gives nations an edge in world markets and allows them to create jobs and maintain high standards of living for their citizens. Debates about economic growth and competitiveness are therefore intimately linked to questions about how to rapidly generate, communicate, translate, synthesize, package and apply information. These questions, in turn, point to a deeper issue -- the character of the information infrastructure that makes these activities possible.

Throughout the 20th century, the United States has had the world's most advanced information infrastructure. In many ways we still do. But rapid changes in technology and the aggressive programs of other countries are challenging America's ability to sustain this advantage in the future. The stakes are high. To a large extent, information infrastructure will determine the comparative advantage of nations in the information age. Just as our superior system has strengthened many diverse sectors of the U.S. economy in the past, so could an inferior one weaken them in the future. As a result, it is urgent for the United States to strive for a more advanced information infrastructure that will help make us more innovative and productive than other nations.

In order to ensure that the United States maintains leadership in this critical area, the Council has started a project on 21st century information infrastructure. Participating in this project are the many different parties who are actually providing and using the infrastructure, including cable companies, the regional Bell operating companies, long-distance carriers, cellular firms, computer hardware, software and service companies, banks, broadcasters, publishers, labor unions and universities. These groups have different interests and do not agree on every issue, but by developing a broad-based private sector consensus in key areas the Council hopes to help accelerate the deployment of an advanced information infrastructure.

This vision statement represents such a consensus. In it, we discuss why an advanced information infrastructure is so important to the United States and point the way to future progress. To help realize this vision, the Council intends to follow up with work on a core set of related issues. During the next two years, we will profile key demonstration projects around the country, address pivotal policy questions, and explore critical technology challenges. In

doing so, our intent is to focus on concerns that go beyond narrow special interests to the broader national interest and to develop the private sector consensus that is so important to an informed public policy.



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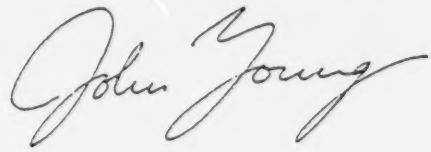

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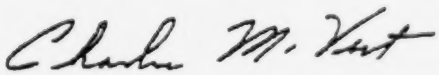

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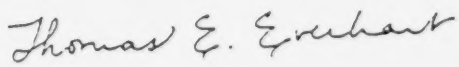

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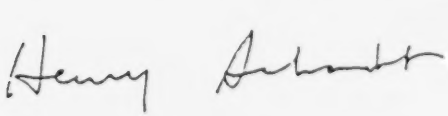

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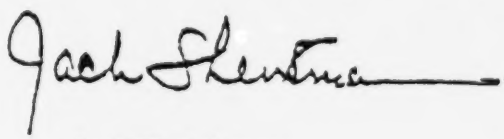

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EXECUTIVE SUMMARY

WHAT IS OUR VISION?

The information infrastructure of the 21st century will enable all Americans to access information and communicate with each other easily, reliably, securely and cost-effectively in any medium -- voice, data, image or video -- anytime, anywhere. This capability will enhance the productivity of work and lead to dramatic improvements in social services, education and entertainment.

Information infrastructure can be divided into four interdependent parts: a set of widely accessible and interoperable communications networks; digital libraries, information databases and services; easy-to-use information appliances and computer systems; and trained people who can build, maintain and operate these resources. What is important is the ability to assemble all the necessary technical elements on demand to satisfy market needs.

As government develops public policy, it should keep in mind six key principles: 1) the user comes first; 2) affordability and ease of use are essential; 3) flexibility and responsiveness to market demand are key to success; 4) the regulatory process must be even-handed; 5) a coordinated systems-level approach is crucial; and 6) domestic programs must be sensitive to international considerations.

WHY IS INFORMATION INFRASTRUCTURE IMPORTANT?

Information infrastructure is more than computers, databases and communications networks -- it is people and useful applications. It can help U.S. competitiveness, job creation and pressing social problems. It also is the foundation for other types of infrastructure, and a wide range of products and services.

WHERE DO WE STAND?

The fusion of communications and computing capabilities is setting the stage for an advanced U.S. information infrastructure that will reduce costs, enhance services and create an astounding array of new applications. Other countries are also moving aggressively. While many of our competitors rely on centralized planning, the United States relies on demand-driven, competitive policies. This market approach has made the United States very flexible and responsive to customers and new technologies and should be preserved. But in doing so, we must not ignore the need for public policy reform. The challenge is to find the right balance of regulation, competition and cooperation.

WHAT ARE THE ROLES OF GOVERNMENT AND THE PRIVATE SECTOR?

The government should help articulate the national need for an advanced information infrastructure, act as a catalyst and coordinator, bring U.S. telecommunications regulations in line with new requirements and market opportunities, and ensure that its diverse R&D programs are well managed and designed to advance practical applications. The private sector, by contrast, has the responsibility for building and operating the infrastructure, serving new markets and providing value to its customers.

WHERE DO WE GO FROM HERE?

To reach the long-term goal of a nationwide system of advanced information services, we must establish short-term goals and programs that accelerate progress toward a variable bandwidth, digital, interoperable set of networks that are easy to use and widely accessible. Rather than try to pick winners among technologies or choose one technology platform, the United States should pursue a multifaceted strategy that is ambitious, but flexible and realistic.

Three different proposals to provide digital services deserve consideration: 1) programs that target the underlying technology as a means of creating a new platform for the delivery of goods and services, 2) a redirection of existing federal R&D programs toward practical U.S. business and consumer needs, and 3) regional proof-of-concept experiments that could stimulate promising applications. In pursuing these initiatives, government's goal should be to work with the private sector to identify promising technologies, to encourage industry to develop them, and to fund precompetitive R&D in those areas where barriers to development are so high that they discourage industrial investment. The government should let market forces determine winners and losers.

WHAT ARE THE NEXT STEPS?

The Council plans to profile key pilot projects and demonstration programs around the country and highlight their benefits.

The Council will help create a private-sector consensus on how to address a range of issues that affect the speed of deployment, such as antitrust laws, carrier liability, competition policy, intellectual property protection, international interconnectivity, interoperability, security, spectrum allocation, standards, tax incentives and depreciation schedules, and technology. The Council will also take into account issues that are necessary to protect the public welfare, such as access, affordability, First Amendment rights and privacy.

Finally, the Council will work closely with other organizations to answer key questions related to the status of the underlying technologies.

VISION FOR A 21ST CENTURY INFORMATION INFRASTRUCTURE

This vision statement addresses the need for an advanced information infrastructure in the United States. In it, we focus on six questions: 1) Why is information infrastructure important? 2) Where do we stand? 3) What is our vision? 4) What are the roles of government and the private sector? 5) Where do we go from here? and 6) What are the next steps?

1. WHY IS INFORMATION INFRASTRUCTURE IMPORTANT?

Information infrastructure is more than simply computers, databases and communications networks. It is an engine for economic competitiveness and jobs. It is a means of addressing pressing social concerns. It is the foundation for other types of infrastructure. And it is the basis for a wide range of diverse products and services. The U.S. private sector has already invested hundreds of billions of dollars in the development of this infrastructure. As it evolves, it will redefine the way that people interact with each other and the world around them.

There is no doubt that information infrastructure helps create jobs and drive economic growth. Information networks are dramatically improving the performance of existing industries, such as banking, and paving the way for new ones, such as video-conferencing. In addition, they provide the backbone for the education and training programs that are so crucial to a high-performance American workforce. By helping to keep the U.S. industrial base healthy, opening new markets, and strengthening the skills of U.S. workers, information infrastructure has a big impact on our ability to compete in world markets and to generate good jobs in the United States.

Information infrastructure also provides a means of addressing urgent social problems. Health care and education are prime examples. By establishing an automated record and billing network for healthcare providers, for example, the United States could substantially reduce its healthcare costs, saving over $30 billion, according to some estimates. Moreover, new applications such as telemedicine could dramatically improve public access to health care. Education also stands to reap enormous benefits. An advanced information infrastructure could make it practical to do such things as link biology students in high schools across the country with world-class biotechnology experts who could show them the miraculous new world of biotechnology. And it could provide rural and inner city schools with access to a broad array of education programs that are currently beyond their reach.

In addition, a robust information infrastructure is the foundation for all other forms of infrastructure. The ability to deploy intelligent vehicle highway systems, to monitor the environment and to deliver data electronically all depend on information technology. Because the quality of our information infrastructure is so important to our success in these other areas, its value to the national economy cannot be overestimated.

For most Americans, however, the most important issue is the impact of information on their everyday lives. While teleconferencing and the routine use of electronic bulletin boards may still seem like remote possibilities to many people, the appliances of the information age -- telephones, fax machines, televisions and computers -- are familiar to almost everyone. Networks that link these appliances together are redefining how people interact with the world around them. By connecting people to offices, stores, schools and each other in new ways, these information networks are changing the way that Americans work, shop, learn and play.

The significance of America's information infrastructure goes beyond our geographic boundaries. Because markets are increasingly global, the nation's information infrastructure must be able to interact easily with those of other nations. Not only has the global marketplace arrived, but also the global village.

In order to make the most out of our growing reliance on information technology, we need to strive for a more advanced information infrastructure that will help make us more innovative and more productive than other nations. To do so, we must assess where we stand, outline a clear vision of where we want to go, identify a process that will get us there, and clarify the roles of the major players. Because it is impossible to predict the exact path that technology will follow, or the products and services that consumers will demand, flexibility must be the hallmark of the U.S. approach. Throughout, we must strive to make sure that public policies complement market forces and take into account consumer needs.

2. WHERE DO WE STAND?

The first step in the development of an advanced information infrastructure began over 30 years ago when digital technologies began replacing analog. The telecommunications industry is presently in its second major phase, deploying high capacity, digital transport media such as wireless, integrated services digital network (ISDN) and fiber communications. The evolution on the telecommunications side has been paralleled by developments in data communications and computing, which have shifted from proprietary, low-speed, analog systems to non-proprietary, high-speed, digital systems.

We are presently in the beginning of a critical third phase -- substantially upgrading the intelligence of the telecommunications network and moving toward open computer systems. The fusion of communications and computing capabilities that is taking place in today's network is setting the stage for an advanced information infrastructure which will reduce costs, enhance services and create an astonishing array of new applications.

At present, the overall variety and quality of America's information services and communications networks are unmatched anywhere else in the world. Moreover, the United States leads in the computer systems, software and many of the technologies that are at the heart of the information revolution. Ultimately, however, it is not technology but the ability to harness it in the form of practical applications that will determine international leadership.

Other countries have realized the tremendous economic potential of an advanced infrastructure and are also moving aggressively, particularly in the telecommunications area. Attempts to deregulate and privatize parts of the telecommunications industry in Asia and Europe are being carried out as part of broader, national economic development plans. Governments in these regions have embarked on ambitious long-term modernization programs for their telecommunications industries. They are defining major R&D projects, backing them up with serious funding, and using standards and interface definition to support them.

In Japan, Nippon Telephone and Telegraph (NTT) is examining the feasibility of building a broadband network that will reach every school, business and home by the year 2015. In Singapore, the government has announced its "Vision of an Intelligent Island" to accelerate the deployment of an advanced information infrastructure. In Germany, the government has launched a major modernization program called "Telekom 2000" to rebuild the communications network of East Germany and link it to the western part of the country. And France, which already has established an advanced information network in Minitel, has identified telecommunications as its "Great Project" for the 1990s.

The United States has chosen a different course. While many of our major competitors rely on centralized government planning, we rely on demand-driven, competitive policies. As a result, market forces tempered by regulatory restraints drive the deployment of new technologies in the United States. The market environment has made U.S. industry extremely flexible and responsive to changing consumer demands and new technologies. It is essential that we preserve this strength.

In doing so, however, we must not ignore the need for public policy reform. In many respects, the U.S. regulatory framework, particularly in telecommunications, is a hold-over from the 1930s. America's legal and regulatory bodies are fragmented and have trouble keeping up with advances in technology. The Federal Communications Commission and the 53 public utility commissions disagree about key issues, and Congress and the National Telecommunications and Information Agency are weighing in with their own proposals.

The policy issue facing the United States is not centralized government planning versus decentralized markets. The nation has reaped enormous benefits from its market-oriented, competitive strategy and will undoubtedly continue to do so. Instead, the policy challenge is to find the appropriate balance of regulation, competition and cooperation. While we have structured a system of keen competition in the United States, we are poorly organized when it comes to government-industry cooperation on issues affecting the broader national welfare.

This lack of cooperation may well be America's Achilles heel when it comes to rapidly deploying an advanced information infrastructure. Many of the expensive elements, such as long-distance fiber networks and computers, are already in place. So are millions of potential users. What is in short supply is the ability of different parties to work together to define and deploy key elements and interfaces. Because information infrastructure is so all-encompassing, because the need for interoperability and interconnectivity is so critical, and because other

nations are moving so aggressively, it is urgent that the United States find better ways to coordinate its activities.

3. WHAT IS OUR VISION?

The vision for the future of America's information infrastructure can be easily described and is widely shared:

> The information infrastructure of the 21st century will enable all Americans to access information and communicate with each other easily, reliably, securely and cost-effectively in any medium -- voice, data, image or video -- anytime, anywhere. This capability will enhance the productivity of work and lead to dramatic improvements in social services, education and entertainment.

Information infrastructure can be divided into four parts: 1) a set of widely accessible and interoperable communications networks, 2) digital libraries, information databases and services, 3) information appliances and computing systems that are easy to use, and 4) trained people who can build, maintain and operate these resources. Each of these is dependent on the others. The evolution of the overall infrastructure will depend on policies that govern access, cost, use, ownership and competition.

The communications system usually receives most of the attention. Here, too, there is broad consensus among government, industry and the American public. The communications system of the future, like the network of today, will be made of wire, fiber or radio waves, or encompass all of these media. It will be a diverse collection of variable bandwidth, digital, interoperable, interactive, commercially provided, organic networks that are easy to use and universally accessible:

- Diverse because different networks serve different needs and have different characteristics;
- Variable bandwidth because they must carry not only voice, but also image, video and high-speed data;
- Digital because of the ease and accuracy with which digital information can be stored, transferred, moved and managed;
- Interoperable because different networks must be able to communicate easily;
- Interactive because of the need for point-to-point communication;
- Commercially provided because a competitive marketplace ensures the widest range of services and products to the greatest number of users at affordable prices and because private capital is needed for the investment;
- Organic because they will develop at different times and places depending on market needs;
- Easy to use so that they can serve the needs of the broad public; and
- Universally accessible because every American should be able to utilize them.

Describing the communications networks alone, however, fails to capture the full scope of information infrastructure. What is important is the ability to assemble all the necessary technical elements on demand to satisfy a specific market need. The networks are critical because they can make that assembly possible with relative ease in a cost-effective way. They do not, however, take into account issues related to the data banks, computing systems and human resources that are critical elements of information infrastructure or to the economic development and quality-of-life goals that must drive it.

Although it may be easy to describe the physical characteristics of communications networks, it is very difficult to conceptualize information infrastructure in its entirety. The infrastructure is more than just electronic equipment and components, it is also the system of services, relationships and activities that are built around them. Just as the interstate highway system would be useless if it did not have local roads, automobiles, gas stations, motels, driving rules, police, insurance companies, maps and road signs, so too will communications networks be useless unless they are supplemented with training programs, data bases, computing capabilities, software protocols, standards, security systems, intellectual property laws and services that support economic growth and societal well-being.

In order to develop public support for the many diverse elements of information infrastructure, it will be necessary to demonstrate its utility to the American public. Many documents have described its revolutionary impact on such fields as health care, entertainment, manufacturing, transportation and education. There is no doubt that an advanced information infrastructure will fundamentally change these sectors, but its full implications go beyond the impact on any one industry.

In many ways, the most important aspect of the evolving information infrastructure is the new system of services, social concepts and international connections that it will enable. In basic ways, it will transform people's habits, perceptions, values and relationships. Just as the industrial revolution served as an agent of massive cultural change a century ago, so too will the ongoing information revolution. An advanced, easy-to-use information infrastructure will be the vehicle for much of this change.

These developments are as hard to quantify as they are to predict, but several trends are worth noting:

- First, rather than take people to services, services will come to people. Instead of going to libraries to do research, students will access data from information appliances. Instead of going to a physician's office for routine check-ups, patients will communicate with doctors and exchange vital data electronically. Instead of going to City Hall and waiting in line, citizens will be able to access the necessary information from their homes, their offices and their schools.

- Second, personal communications will be available to people anytime, anywhere. New systems will go beyond mobile telephones and pagers to include devices that combine portable computing, video and communications systems.

- Third, different business activities, both within a single company and across different business enterprises, will be integrated regardless of geographic location. Within companies, marketing, R&D, finance and manufacturing will be able to communicate easily and instantly, despite the fact that they use different equipment, deal with different kinds of problems and may be thousands of miles apart. Perhaps even more importantly, companies will be able to form new kinds of alliances, consortia and joint ventures. The virtual enterprises that result will represent an entirely new business model that will have a major impact on the organization of work.

- Fourth, individuals will be able to access unique equipment that is often continents away, such as specialized manufacturing design tools, telescopes, supercomputers and sophisticated measurement devices. This access will allow individuals to remotely manipulate, measure and interact with these resources. In the process, it will put the power of advanced technology into the hands of many who cannot afford it today.

- Fifth, as more and more people gain access to technology, new waves of innovation will be unleashed. As entrepreneurs realize the potential of an advanced information infrastructure, they will use it to develop a host of new products and services. And as scientists and engineers realize its capabilities, they will use it to drive R&D and new applications.

- Sixth, there will be far-reaching economic implications. As information assumes a more pivotal role in the economy, those without access to it or training to use it will find themselves disenfranchised. This division between information haves and have-nots represents a potential dark side of the information revolution. All Americans share a responsibility to avoid a more severe polarization between the privileged and underprivileged. As a result, both government and the private sector must pay careful attention to issues of equity, affordability and access.

These six changes will not only have a major impact on the everyday lives of Americans, but also on our relationships with other countries. As U.S. public policy attempts to come to grips with these challenges, the government should bear in mind the fact that the best way to enable the creation of an advanced information infrastructure is to let competitive forces work constructively in the marketplace. The following six principles are helpful rules of thumb:

1. The user comes first. The main goal of public policy should be to provide users with the maximum possible levels of choice, service and mobility, with due respect to privacy, confidentiality and security. It must also address the need for fair and open access.

2. Affordability and ease of use are essential. Public policy should continue to encourage the private sector to minimize costs and maximize choice and quality across all segments of the infrastructure. It should also encourage the development of systems that are easy to use, widely accessible and interoperable.

3. Flexibility and responsiveness to market demand are key to success. Although some features of the near-term information infrastructure are clear, others are not, as is to be expected from a rapidly evolving technology base and changing market needs. A key goal of public policy should be to facilitate the ability of industry to take advantage of new technical developments and address shifting market needs.

4. The regulatory process must be even-handed. The policy context should be industry-neutral and technology-neutral so that it impartially promotes those applications that are efficient and affordable for individual consumers and companies of all sizes. It should also be structured so that it encourages systematic private sector investment.

5. A coordinated, systems-level approach is crucial. Just as companies must coordinate the activities of different divisions, so too must the government coordinate its R&D programs, procurement polices, regulatory decisions and pilot projects both with each other and with the private sector.

6. Domestic programs must be sensitive to international concerns. U.S. public policy must take into account the international dimensions of information infrastructure, including such issues as connectivity, intellectual property, competitiveness, and the evolution of U.S. networks compared to those overseas.

4. WHAT ARE THE ROLES OF GOVERNMENT AND THE PRIVATE SECTOR?

If the vision for a 21st century information infrastructure can be stated, why is there so much concern about the pace of America's progress toward it? The answer is that there is a lot of confusion about the state of the infrastructure that already exists today and uncertainty about how best to accelerate deployment and assemble the component parts into an advanced nationwide system. Such issues as how it will evolve, what rules will govern access, how it will be paid for and who will provide key services are the subject of lively debate. Policy discussions center on one fundamental issue -- how to determine the proper balance between a diverse, evolutionary approach driven by competitive market forces and closer government-industry coordination.

Government's first task is to help articulate the national need for an advanced information infrastructure. Through policy statements, demonstration projects and public procurement, the government must emphasize the need for the infrastructure. For example, the Department of Defense, the National Institutes of Health, and state health and education agencies can serve as early customers for systems related to security, medical research and education. In doing so,

they can demonstrate the value of existing technology and help pave the way for new applications.

The government also has a critical role to play as a catalyst and coordinator. At both the federal and state levels, as well as nationally and internationally, government should convene users and providers to forge a strategy, or at least a common understanding and some shared goals. President Clinton's proposed high-level interagency task force within the National Economic Council (NEC) is a step in the right direction. This task force must have enough power and reach to be credible to different departments and agencies within the government and to the general public. Ultimately, however, its authority will derive from its ability to elicit the broad involvement of interested parties -- especially the private sector -- and to develop a national consensus. The Council on Competitiveness looks forward to working closely with this group.

In addition, government must bring U.S. telecommunications regulations in line with new requirements and market opportunities. In the past, the fragmented government regulatory environment has often tended to inhibit competition and delay deployment of new technology. A progressive regulatory environment is critical to the effort to encourage the private sector to rapidly develop new technology and deploy the kind of information infrastructure that the nation will need in the 21st century.

Finally, government must make sure that its diverse R&D programs are well managed and designed to advance practical applications. It should serve as an early funder of research and large-scale experiments that are out of reach of individual companies because of risk, cost and time-to-maturation. And it should make sure that the private sector has appropriate access to this R&D. Agencies such as the Advanced Research Projects Agency, the National Institute of Standards and Technology and the National Science Foundation can catalyze and support pre-competitive research in critical areas.

The private sector, by contrast, has the responsibility for actually building and operating the infrastructure, for serving new markets and for providing value to its customers. It must explore new market opportunities, make systematic investments in technology and applications, and constantly seek to deliver high-quality goods and services. As part of this effort, it should bear in mind the role that mass-market consumer services play in creating demand, bringing down costs and generating wealth.

Leadership in technology is not enough. Industry must complement its strength in technology with strength in services and manufacturing. Industry must remain open to working with government, labor, universities, consortia and users to drive the creation of new technologies and develop new applications. In addition, industry must be knowledgeable about the progress of technologies and markets in other countries and be increasingly alert to exporting and other commercial opportunities that will enhance its position in the world marketplace.

5. WHERE DO WE GO FROM HERE?

Much of the discussion about how to mesh public policy with market forces can be clarified by understanding the next plateau of service after the telephone. In order to reach the long-term goal of a nationwide system of advanced information services, we must establish short-term goals and programs that accelerate progress toward a variable bandwidth, digital, interoperable set of networks that are easy to use and widely accessible.

These short-term goals must not only serve existing demand, but also help stimulate new applications. A key to the rapid deployment of more bandwidth, for example, is to build public support for applications that use it. The immediate objective, however, should be to make users comfortable with the technology and applications that the current network can readily deliver.

Rather than try to pick winners among technologies or choose one technology platform, the United States should pursue a multifaceted strategy that is ambitious, yet flexible and realistic. After all, it took half a century to make plain old telephone service (POTS) available to all Americans; it has taken decades to make personal computers widely available; and it will take at least a decade to make plain old digital service (PODS) universally available.

Three different kinds of proposals to provide digital service deserve consideration. First, there are programs that target the underlying technology as a means of creating a new platform for the delivery of goods and services. One set of examples includes narrow-band integrated services digital network (ISDN), asymmetric digital subscriber line (ADSL) technology, and high-bit-rate digital subscriber line (HDSL) technology. These could be deployed in existing networks and would enhance the level of current services, enabling voice, data, fax, image and multimedia capabilities. While these technologies do not address the need for very high bandwidth in some applications, they utilize existing twisted-pair copper wire and have unquestionable immediate utility for the mass market. Some doubt, however, whether they are ambitious enough to serve as enablers for more advanced services.

A second example that targets the underlying technology aims at accelerating the evolution of existing broadband networks, like those providing cable television. This approach is recommended for several reasons: there is already an extensive installation of broadband-to-the-home, one-way delivery systems; these systems are rapidly digitizing for core business reasons and will see their capacity grow in the near future; interactive communications applications on such systems are projected to increase; the systems are heterogenous, familiar to consumers, easy to use and affordable; and no large public expenditures or reallocation of spectrum is required. In this area too, however, there are questions about whether the present collection of local, one-way, analog video distribution systems and ad hoc architectures can be extended to more demanding uses that require greater versatility.

A third example in this category involves wireless communications. There has been an explosion in wireless technologies and applications in the past decade, not only in the United States, but also in less developed countries such as China that do not have a viable wired

infrastructure. Plans are also underway to establish global wireless networks. Given the ability of wireless communications to provide mobility and remote access, there is no doubt that it will play an important part in the evolution of the U.S. information infrastructure. There is some question, however, whether it will be capable of supplying sufficient bandwidth for multi-media applications.

A second category of proposals involves redirecting existing Federal R&D programs toward practical U.S. business and consumer needs. For example, the Federal government's High Performance Computing and Communications Initiative (HPCCI) is currently limited to sophisticated supercomputer applications that focus on the needs of the research community. Legislation is pending that would expand this initiative to include greater attention to manufacturing, libraries, education and health care and involve the relevant government agencies. By targeting practical applications in these areas, the HPCCI could make a major contribution to the deployment of an advanced information infrastructure.

Finally, the Federal government could champion specific regional proof-of-concept experiments that hold promise for stimulating promising applications. One example of such a program is "Smart Valley," Silicon Valley's attempt to bring together information services, digital devices, advanced infrastructure and people who are trained to use them. Another is the Southeastern Manufacturing Technology Center's effort to develop a virtual factory that will give small and medium-sized manufacturers access to advanced technology. Such programs constitute the kinds of pilot projects that are necessary to develop new policy models, translate theory into practice and spur the actual deployment of advanced networks across the country.

In pursuing these technology initiatives, government's goal should be to work with the private sector to identify promising technologies, to encourage industry to develop them, and to fund pre-competitive R&D in those areas where barriers to development are so high that they discourage industrial investment. The government should let market forces determine winners and losers.

In the end, some combination of these different kinds of technology initiatives will probably be adopted. What is important is to make sure that programs aimed at these medium-term technical goals are part of a broader, joint public-private effort to accelerate the development of a wide range of applications. It is these applications -- not the technology itself -- that will determine the vitality of America's national information infrastructure.

While trying to stimulate the technology underlying the infrastructure, the government must not lose sight of the decisive influence of the regulatory environment. More than any technology program, the regulatory framework will determine the face of America's information infrastructure. The best role for government is the one that is least intrusive. Government regulations should aim to create a playing field that allows for all interested parties to exploit market opportunities, as competitive issues warrant. This is not only true for domestic markets, but also for international competition, since foreign firms have greater access to the American market than U.S. firms have overseas. Both in the GATT and other international fora, the

government should aggressively seek to open foreign markets and to provide greater intellectual property protection.

6. WHAT ARE THE NEXT STEPS?

The Council on Competitiveness has outlined three steps that are necessary to advance the rapid deployment of a 21st century information infrastructure and intends to pursue initiatives in all three areas actively.

First, the tremendous advantages that an advanced information infrastructure offers in such areas as health care, education and manufacturing must be conveyed to the American public. In order to aid this effort, the Council will profile key pilot projects and demonstration programs around the country and highlight their benefits. Moreover, it will work to emphasize the wide variety of applications information infrastructure makes possible and bring them to the attention of policymakers in Washington, D.C.

Second, government and the private sector must address several thorny policy issues that cut across the communications networks, computing systems and databases that constitute the physical infrastructure. These issues can be divided into two broad categories, although there is some overlap between them. In one category are issues that will determine how fast the infrastructure will be deployed, such as the following:

- antitrust laws
- carrier liability
- competition policy
- intellectual property protection
- international interconnectivity
- interoperability
- security
- spectrum allocation
- standards
- tax incentives and depreciation schedules
- technology

In another category are the policy issues that are necessary to preserve the public interest. Included in this category are the following:

- access
- affordability
- First Amendment rights
- privacy

The Council will set up a process to address these issues, isolating make-or-break concerns and developing a core private sector consensus in key areas.

Third, key questions related to the status of the underlying technologies must be addressed. There are a number of groups working on core technical issues and related policy concerns. The Council plans to work closely with organizations interested in this aspect of the issue, such as the Corporation for National Research Initiatives (CNRI) and the network of policy groups assembled in cooperation with Harvard University.

In the end, the strength and vitality of America's information infrastructure will depend not only on healthy competition, but also on constructive cooperation between the public and private sectors. We look forward to working with Congress and the new Administration to make this kind of cooperation a reality.

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This report would not have been possible without the involvement and extensive guidance of the individuals from industry, academia and labor who serve on the advisory committee. They not only provided valuable substantive insights, but also demonstrated a willingness to work together to build consensus. A full list of the advisory committee is provided on the following pages.

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Founded in 1986, the Council on Competitiveness is a nonprofit, nonpartisan organization of chief executives from business, higher education and organized labor who have joined together to pursue a single overriding goal: to improve the ability of American companies and workers to compete in world markets while building a rising standard of living at home.

To build consensus within the public and private sectors on the actions needed to help Americans compete, the Council pursues a three-part agenda: increase public awareness of the breadth and severity of America's economic problems; mobilize the political will required to set the United States on a positive economic course; and assist in the development of specific public policies and private-sector initiatives. To that end, the Council focuses on issues in the areas of fiscal policy, science and technology, international economics and trade, and human resources.

The Council is governed by an executive committee and draws on the resources of its national affiliates — over forty trade associations, professional societies and research organizations — to help analyze issues and develop consensus. The Council is privately supported through contributions from its members, foundations and other granting institutions.

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